

Detection of asymptomatic renal calcifications in astronauts using a novel ultrasound protocol

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INTRODUCTION: Ultrasound (US) specifically looking for asymptomatic renal calcifications that may be renal stones is typically not done in the terrestrial setting. Standard abdominal US without a renal focus may discover incidental, mineralized renal material (MRM); however punctate solid areas of MRM <3 mm are usually considered subclinical. Detecting these early calcifications before they become symptomatic renal stones is critical to prevent adverse medical and mission outcomes during spaceflight.

METHODS: The NASA Flight Medicine Clinic (FMC) uses a novel US protocol to screen for MRM. Active astronauts get annual, preflight, and post-flight scans for MRM. Using this protocol both kidneys are imaged using greyscale and Doppler US, taken in four positions: supine, left lateral, right lateral, and seated. Five characteristics help define MRM: shadowing, Doppler twinkle, frequency dispersion, size and anatomic location. A panel of FMC clinicians reviews each study, and records characteristics of any MRM seen. This information is entered into a tracking system for comparison with future scans. Any clinically relevant findings are referred for immediate specialist evaluation.

RESULTS: Twenty-six annual and 3 post-flight exams have been done. All active astronauts will have had their annual study by the spring of 2017. A complete analysis of MRM metrics is pending collection of a significant number of studies.

DISCUSSION: The NASA FMC renal ultrasound protocol provides a means to discover and track subclinical MRM to assess risk for development of renal stones. Early detection of potential stone precursors is critical for defining risks where no information has previously existed. This methodology will help decrease the medical and mission risks of renal stones during spaceflight by ensuring that all actual and potential renal stones are addressed well before flight.